983-36 Quantitative Analysis of How Epicardial Activation Changes With Time During Ventricular Fibrillation

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Few details are known about the behavior of activation fronts (AFs) during ventricular fibrillation (VF). Therefore, we developed computerized methods to quantitate (I) the number of AFs per s, (II) the number of AFs passing each epicardial site per s, (III) the conduction velocity of the AFs in m/s, (IV) the number of AFs that fragment into 2 AFs per s because of block, and (V) the number of AFs that collide and coalesce into a single AF per s. Unipolar potentials were recorded from a 504 (21X24) electrode plaque (2 mm interelectrode spacing) covering ≈ 20 cm2 of the anterior RV and LV in 5 pigs. In each animal, six episodes of VF were induced by premature stimulation (1–12 mA). Segments of VF (1 s) starting 0, 10, 20, 30 and 40 s post-induction were analyzed.

	0–1′	10–11′	20–21′	30–31′	40–41′
I	50 ± 16*	77 ± 13*	74 ± 13*	66 ± 11	61 ± 14
II	8.9 ± 1.4	8.0 ± 1.4*	7.6 ± 1.1*	7.4 ± 1.0	7.2 ± 1.0
III	0.33 ± 0.8*	0.25 ± 0.1*	0.21 ± 0.04	0.21 ± 0.04	0.20 ± 0.04
IV	8.0 ± 3.8*	11.5 ± 4.3	11.7 ± 5.5	11.6 ± 4.2	11.2 ± 5.2
V	5.5 ± 2.9*	11.3 ± 4.6*	9.8 ± 3.4	9.2 ± 5.5	8.2 ± 3.8

*Data are mean ± SD; *denotes p < 0.05, repeated measures ANOVA.*

Over the first 41 s of VF, (1) the number of AFs and the number of AF collisions first increases and then decreases, (2) the number of AF fragmentations increases early and then stabilizes, and (3) the conduction velocity continuously decreases. Thus, the nature of activation changes with time during VF and these changes can be quantified using computer techniques.

984 Left Atrial and Left Ventricular Function

Tuesday, March 26, 1996, 3:00 p.m.–5:00 p.m.
Orange County Convention Center, Hall E
Presentation Hour: 4:00 p.m.–5:00 p.m.

984-109 Left Atrial Pressure-Volume Relation in Humans: A New Method Based on Direct Nontransseptal Left Atrial Catheterization and Echocardiography

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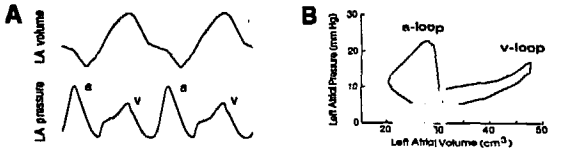
To obtain left atrial (LA) pressure-volume loops, simultaneous LA pressure and volume tracings were recorded in 25 patients during cardiac catheterization. LA pressure was measured by a catheter-tip micromanometer, which was inserted retrogradely into the LA cavity, using a purely retrograde nontransseptal LA catheterization technique based on a steerable catheter developed in our institution. Instantaneous LA volume measurements were obtained by application of real-time two-dimensional echocardiographic automatic boundary detection technique. The pressure and volume signals were stored in a computer, and the simultaneous LA volume and pressure tracings (fig A) and LA pressure-volume loops (fig B) were derived by processing of stored data. Moreover, measurement of the a-loop area (fig B), corresponding to LA contraction, provided LA systolic work. All clinical applications were fast, easy and uncomplicated.



This new method provides a safe and easy way for the determination of LA pressure-volume relation in conscious humans during cardiac catheterizations. Study of this relation may provide insight into the LA mechanics in various normal and diseased conditions.

984-110 The Stagnation of Left Atrial Appendage Blood During Sinus Rhythm in Patients With Transient Atrial Fibrillation Assessed by Transpulmonary Contrast Echocardiography

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The purpose of this study is to clarify the flow pattern of left atrial appendage (LAA) in patients (pts) with transient atrial fibrillation (AF) during sinus rhythm (SR). We performed transesophageal echocardiography in 15 pts with transient AF during SR (Group SAF), 14 pts with chronic AF (Group CAF) and 5 healthy subjects (Group NSR). The flow in LAA was visualized by injection of Albunex (0.15 ml/kg) from the right internal jugular vein. The following parameters were measured: the peak contrast intensity (PI) in basal half of LAA (A1) and apical half of LAA (A2) by videodensitometry (Freeland System), the flow velocity in A1 and A2 by pulsed Doppler echocardiography and the left atrial volume by transthoracic echocardiography. *Result:* In Group CAF, the peak intensity of A1 and A2 was significantly low compared with Group SAF ($p < 0.05$)and Group NSR ($p < 0.05$), respectively. In pts with SR, Group SAF and Group NSR, there were significant negative correlations between LA volume and PI of A1 and A2, respectively ($r = -0.55$, $p < 0.05$ and $r = -0.75$, $p < 0.001$). In Group SAF, eight of 15 pts had large LA (volume > 20 ml) and PI of A1 and A2 was low. There was no significant difference between the flow velocity of LAA in the eight pts and the other. *Conclusion:* In the pts with transient AF, the blood in LAA stagnates even during SR. This stagnation in LAA was associated with left atrial enlargement.

984-111 Echocardiographic Assessment of Left Atrial Volume: Determining Optimal Technique

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Left atrial volume (LAV) is a commonly reported echocardiographic measurement. Although a number of methods have been used to measure it, none has been objectively validated.

Methods: A number of techniques commonly used to measure LAV were evaluated in a series of 12 excised post mortem human hearts. The mitral valve was sewn closed. Soft rubber balloons were passed through a pulmonary vein into the left atrium, filled with water and sealed. The heart was immersed in a water bath and imaged in 3 orthogonal planes analogous to the parasternal (PS), apical 4 chamber (A4C) and 2 chamber (A2C). Diameters and volumes were measured in each plane. LAV was estimated by 3 methods, including: cubing of single diameters, prolate ellipsoid method (PE), and Simpson's rule volume determination. The volume of water in the balloon was then measured to determine true LAV.

Results: The following table shows correlation by linear regression analysis for each method with respect to true LAV.

	Diameter cubed Method			PE	Simpson's Volume		
	PS	A4C	A2C		PS	A4C	A2C
R	0.74	0.50	0.63	0.73	0.88	0.82	0.90
sig.	0.009	0.120	0.035	0.010	0.001	0.002	0.001
S.D.	30.8	53.2	48.4	21.4	11.2	12.4	11.4

Conclusions: LAV is most reliably estimated echocardiographically by Simpson's rule volume calculations obtained in apical imaging planes.

984-112 Left Atrial Dysfunction in Heart Failure Patients With Restrictive Transmitral Flow Pattern by Doppler Echo

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Heart failure patients (pts) with the restrictive transmitral flow pattern by Doppler echo have been demonstrated to have increased functional impairment and higher mortality. However, the role of left atrial transport in contributing to LV dysfunction in such patients is unknown. Therefore, we analyzed the relation of transmitral flow (TMF) patterns and pulmonary venous flow (PVF) velocities in 51 heart failure pts (29 men, 22 women; age 61 ± 9 yrs) with an ejection fraction (EF) < 40%. Transthoracic echo and pulsed Doppler were performed from the apical 4-chamber view at the mitral annulus level for TMF, and at the orifice of the right upper pulmonary vein using color flow guidance for PVF. Measurements: TMF early (E) and late (A) velocities; PVF systolic (S), diastolic (D), atrial reversal (Ar) velocities (cm/s); left atrial size (LA, cm) and heart rate (HR). 13 pts of the study population had right heart catheter measurements of the pulmonary wedge pressure (PWP). Pts were assigned to two groups according to TMF: a restrictive (21

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